

Attorney Docket No.: 010327-008210US

Client Reference No.: 30

## **PATENT APPLICATION**

### **METHOD AND SYSTEM FOR PROVIDING REGISTRATION-BASED SIP NAT TRAVERSAL**

Inventor(s): Terry Hardie, a citizen of New Zealand, residing at  
228 Appian Way  
Union City, CA 94587

Troy Pummill, a citizen of United States, residing at  
2900 Maplethorpe Lane  
Soquel, CA 95073

Assignee: Network Equipment Technologies, Inc.  
6900 Paseo Padre Parkway  
Fremont, CA 94555

Entity: Large Business Concern

TOWNSEND and TOWNSEND and CREW LLP  
Two Embarcadero Center, Eighth Floor  
San Francisco, California 94111-3834  
Tel: 415-576-0200

## **METHOD AND SYSTEM FOR PROVIDING REGISTRATION-BASED SIP NAT TRAVERSAL**

### **CROSS-REFERENCES TO RELATED APPLICATION(S)**

5   **[0001]**       The present application claims the benefit of priority under 35 U.S.C. § 119 from U.S. Provisional Patent Application Serial No. 60/458,549, entitled "REGISTRATION-BASED SIP NAT TRAVERSAL" filed on March 26, 2003, the disclosure of which is hereby incorporated by reference in its entirety for all purposes.

### **BACKGROUND OF THE INVENTION**

10   **[0002]**       The present invention generally relates to network communications and, more specifically, to a method and system for facilitating communications between devices where a network access translation device is used.

15   **[0003]**       Fully functional telephony relies on the ability for any party to call any other party. NAT (Network Access Translation) devices represent a significant barrier to SIP (Session Initiation Protocol) calls. This is because NAT devices prevent SIP clients outside the NAT's domain (NAT-exterior) from calling or reaching a client located within the NAT's domain (NAT-interior). For clarification, a NAT device can be viewed as a dividing point between two networks. Devices behind the NAT device are protected from the devices  
20   installed on the network beyond, or outside, the NAT device. Devices connected behind the NAT device are on the interior network, hence they are NAT-interior devices. Those devices not connected behind the NAT device are on the exterior network, hence they are NAT-exterior devices.

25   **[0004]**       By its nature, NAT devices block inbound communication streams, unless a NAT-interior client initiates the communication session. With a NAT device installed, it is practically impossible for a NAT-exterior device to originate a call to a NAT-interior device.

30   **[0005]**       There are several methods presently posed by the industry in response to the foregoing issue including, for example, virtual private networks, STUN servers, SIP-aware NAT devices and proprietary client software/server. All of these solutions, though

functional, are complex and require additional, dedicated hardware and/or proprietary

software. The proprietary nature of these arrangements, however, hinder their usefulness, because clients are unable to communicate with other servers that do not employ their proprietary protocols. It may be possible for an enterprise (company) to install these types of solutions for their employees. However, these solutions hardly address the goal of ubiquitous communications via SIP.

[0006] Hence, it would be desirable to provide a system that is capable of resolving the foregoing problem, as well as others, including facilitating improved communications between devices where a NAT device is involved.

## **BRIEF SUMMARY OF THE INVENTION**

[0007] A system for providing network access translation device traversal to facilitate communications is provided. In one embodiment, the system includes a network access translation (NAT) device, a first Session Initiation Protocol (SIP) client located on the interior of the NAT device, a second SIP client located on the exterior of the NAT device, and a proxy server configured to maintain registration information relating to the first SIP client and the NAT device. The proxy server is further configured to allow the second SIP client to initiate contact with the first SIP client and establish a communication session using the registration information. The communication session is established by traversing the NAT device.

[0008] The registration information is periodically provided to the proxy server based on a condition including startup of the first SIP client. The registration information includes an Internet Protocol (IP) address abstraction, NAT-translated IP address and port information. The registration information includes information supplied by the first SIP client and the NAT device respectively.

[0009] Upon the first SIP client forwarding its portion of the registration information to the proxy server via the NAT device, the NAT device creates a binding for the first SIP client. The binding and the registration information are used to allow the second SIP client to initiate contact and establish the communication session with the first SIP client by traversing the proxy server and the NAT device.

[0010] When the second SIP client wishes to initiate contact with the first SIP client, the second SIP client forwards a SIP INVITE command to the proxy server. Upon receiving the SIP INVITE command, the proxy server uses the registration information to identify the

NAT device and forwards the SIP INVITE command to the NAT device. Upon the NAT device receiving the SIP INVITE command, the NAT device uses the binding to forward the SIP INVITE command to the first SIP client. Upon the first SIP client accepting the SIP INVITE command, SIP signaling between the first SIP client and the second SIP client can be conducted through the NAT device, the ports being identified by the response that the second SIP client receives from the first SIP client.

[0011] In one implementation, the proxy server is part of a telephone gateway.

[0012] Reference to the remaining portions of the specification, including the drawings and claims, will realize other features and advantages of the present invention.

Further features and advantages of the present invention, as well as the structure and operation of various embodiments of the present invention, are described in detail below with respect to accompanying drawings, like reference numbers indicate identical or functionally similar elements.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

[0013] FIG. 1 is a simplified block diagram showing an illustrative configuration of a system according to an embodiment of the present invention.

## **DETAILED DESCRIPTION OF THE INVENTION**

[0014] The present invention in the form of one or more exemplary embodiments will now be described. FIG. 1 is a simplified block diagram showing an illustrative configuration of a system according to an embodiment of the present invention. As shown in FIG. 1, the system 100 includes a SIP client (NAT-interior) 102, a private computer network 104, a network translation access (NAT) device 106, a public computer network 108, a proxy server 110, a public switched telephone network 112 and a SIP client (NAT-exterior) 114.

[0015] In one exemplary aspect, the system 100 facilitates communications between the SIP client 102 located in the NAT-interior with the SIP client 114 located in the NAT-exterior as follows. First, the NAT-interior SIP client 102 communicates with the proxy server 110 via the private computer network 104 and the NAT device 106 to provide certain information to the proxy server 110 for registration purposes. The registration information can be provided to the proxy server 110 in a number of ways. For example, the NAT-interior

SIP client 102 can be configured to register its relevant information with the proxy server 110 upon startup or other designated condition(s).

[0016] The registration information belonging to the NAT-interior SIP client 102 is then recorded and maintained by the proxy server 110 and, as will be further described below, used to establish communications with the NAT-interior SIP client 102. The registration information provided by the NAT-interior SIP client 102 includes, for example, the client name and the source Internet Protocol (IP) address abstraction.

[0017] In addition, the proxy server 110 also captures and records relevant information relating to the NAT device 106. Such information includes, for example, the NAT-translated IP address and port information relating to the port on the NAT device 106 that was used to send the registration information to the proxy server 110. This information is added as part of the registration information for NAT-interior SIP client 102. In one implementation, the registration information is stored in a memory device in the form of a lookup table on the proxy server 110.

[0018] The private computer network 104 can be any computer network employed by an enterprise (company) to provide network communications. The NAT device 106 can be any device that is capable of handling network access translation and is commonly known in the industry. The proxy server 110 is located outside of the NAT device 106 relative to the NAT-interior SIP client 102.

[0019] When the NAT-interior SIP client 102 registers with the proxy server 110 via the NAT device 106, a binding, 106i, is created in the NAT device 106. The binding provides a path or link for the proxy server 110 to subsequently reach the NAT-interior SIP client 102 via the NAT device 106.

[0020] The proxy server 110, and the registration information for the NAT-interior SIP client 102 maintained thereon, can be used to establish communications between the NAT-interior SIP client 102 and the NAT-exterior SIP client 114. When the NAT-exterior SIP client 114 wishes to call the NAT-interior SIP client 102, the NAT-exterior SIP client 114 first sends a command, such as a SIP INVITE command, and other identification information to the proxy server 110. Other identification information includes, for example, information identifying the NAT-interior SIP client 102. The proxy server 110 then looks up the registration information belonging to the NAT-interior SIP client 102, including the corresponding NAT-translated IP address and port information. Using the registration

information, the proxy server 110 then forwards the SIP INVITE command to the NAT device 106 on the IP address and port identified in the registration information. By sending the SIP INVITE command on the registration-derived address/port, rather than the well-known SIP signaling port (5060), the proxy server 110 ensures that the SIP INVITE command will traverse the NAT device 106 using the binding 106i.

[0021] As mentioned above, a binding 106i for the NAT-interior SIP client 102 is created when the NAT-interior SIP client 102 communicates with the proxy server 110 via the NAT device 106 for registration purposes. Since the NAT device 106 is already bound for that (NAT-interior) source IP address and port number, the NAT device 106 is then able to forward the SIP INVITE command to the intended NAT-interior SIP client 102 from the SIP proxy server 110.

[0022] Upon receiving the SIP INVITE command, the NAT-interior SIP client 102 establishes communications with the NAT-exterior SIP client 114, creating a new binding 106ii in the NAT device 106. The remaining SIP signaling between the NAT-interior SIP client 102 and the NAT-exterior SIP client 114 is then conducted via that port.

[0023] In order to prevent the binding 106i in the NAT device 106 from expiring, the NAT-interior SIP client 102 periodically communicates with the proxy server 110 via the NAT device 106 to supply the registration information. Or viewed another way, the NAT-interior SIP client 102 periodically registers with proxy server 110 thereby maintaining a valid binding in the NAT device 106. As a result, the NAT-interior SIP client 102 always maintains a valid binding in the NAT device 106, thereby allowing any NAT-exterior SIP client 114 to initiate communications with the NAT-interior SIP client 102 via the proxy server 110. The periodic registration can be achieved for example, as described above, by configuring the NAT-interior SIP client 102 to register with the proxy server 110 upon startup or other designated condition(s).

[0024] Referring to FIG. 1, the operations of the system 100 is further illustrated with the following example. Registration information associated with the NAT-interior SIP client 102 is shown as information 102i including its IP address (192.168.1.10), IP address abstraction (user@net.com) and port information (5060). Information for the binding created when the NAT-interior SIP client 102 registers with the proxy server 110 is shown as information 106i. In this example, the binding information 106i shows that the private IP address and port (192.168.1.10:5060) is associated with public IP address and port

(134.56.1.1:5070) and final destination IP address and port (134.56.3.1:5060). Port (5060) is used to transmit traffic to and from the NAT-interior SIP client 102 and port (5070) is used to transmit traffic to and from the SIP proxy server 110.

5       **[0025]**       For registration, the NAT-interior SIP client 102 forwards a registration request (having registration information described above) to the NAT device 106 which, in turn, forwards the registration request to the proxy server 110 in a registration packet. The proxy server 110 compares the IP address contained within the registration request with the source IP address for the (registration) packet (the source IP address of the registration packet is the NAT device's 106 IP address). If they do not match, the proxy server 110 can infer  
10       that the client is probably behind a NAT device 106. In such circumstances, any SIP message from the SIP proxy server 110 to the NAT-interior SIP client 102 should be forwarded to the NAT device's IP address, and not the IP address and port contained within the registration request.

15       **[0026]**       Upon registration, the proxy server 110 records the registration information relating to the NAT-interior SIP client 102 shown as information 110i including the IP address abstraction (user@net.com), the NAT-translated IP address (134.56.1.1) and port information (5070). Note, that the NAT-translated IP address comes from the registration packet itself, and the IP address and port inside the registration request (192.168.1.10:5060) are discarded.

20       **[0027]**       When the NAT-exterior SIP client 114 wishes to establish a communication session with the NAT-interior SIP client 102, the NAT-exterior SIP client 114 sends a SIP INVITE command to the proxy server 110. The SIP INVITE command includes, for example, the IP address abstraction (user@net.com) that corresponds to the NAT-interior SIP client 102. Using information from the SIP INVITE command, such as the IP address  
25       abstraction, the proxy server 110 locates the relevant registration information 110i for the NAT-interior SIP client 102. The relevant registration information 110i including the NAT-translated IP address (134.56.1.1) and port information (5070) is then used to contact the NAT-interior SIP client 102. The NAT-translated IP address (134.56.1.1) identifies the appropriate NAT device 106 and the port information (5070) identifies the appropriate port  
30       on the NAT device 106 that can be used to establish contact with the NAT-interior SIP client 102. The proxy server 110 then forwards the SIP INVITE command to the NAT device 106 via port (5070) based on the relevant registration information 110i.

**[0028]** The NAT device 106 subsequently retrieves the corresponding binding information 106i. Using the binding information 106i, the NAT device 106 identifies the port (5060) that is registered to the NAT-interior SIP client 102 and forwards the SIP INVITE command to the NAT-interior SIP client 102.

5 **[0029]** Once the NAT-interior SIP client 102 has processed and accepted the SIP INVITE command, SIP signaling between the NAT-interior SIP client 102 and the NAT-exterior SIP client 114 can be initiated, creating a new binding 106ii in the NAT device 106.

**[0030]** Subsequent communications between the NAT-interior SIP client 102 and the NAT-exterior SIP client 114 can be achieved through the NAT device 106 using the newly  
10 created binding 106ii.

**[0031]** In an exemplary implementation, the present invention is implemented using software in the form of control logic, in either an integrated or a modular manner. Alternatively, hardware or a combination of software and hardware can also be used to implement the present invention. Based on the disclosure and teachings provided herein, a  
15 person of ordinary skill in the art will know of other ways and/or methods to implement the present invention.

**[0032]** In an exemplary implementation, the present invention is implemented as part of a telephone gateway. Based on the disclosure and teachings provided herein, a person of ordinary skill in the art will know of other ways and/or methods to deploy the present  
20 invention.

**[0033]** Based on the disclosure and teachings provided herein, it should also be clear to a person of ordinary skill in the art that the present invention requires neither proprietary clients, nor dedicated, specialized servers. The present invention builds upon current industry standards. Fully functional communication is possible with small architectural changes  
25 within client devices that are commonly available in the industry and such changes do not affect the client device's compliance with SIP standards. Such client devices coupled with the proxy server as described above provide seamless Internet telephony services regardless of NAT installations.

**[0034]** It is understood that the examples and embodiments described herein are for  
30 illustrative purposes only and that various modifications or changes in light thereof will be suggested to persons skilled in the art and are to be included within the spirit and purview of



this application and scope of the appended claims. All publications, patents, and patent applications cited herein are hereby incorporated by reference for all purposes in their entirety.